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Making good choices: self-determination theory and hypersomnolence in higher education

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Abstract

General causality orientations, as defined by Deci and Ryan (2001), suggest that individuals orient towards three different motivational styles: autonomous, controlled, and impersonal. Autonomous orientations refer to the extent to which someone feels self-motivated and self-regulates their own abilities. In contrast, controlled orientations are motivated by external pressures such as punishments or rewards. Finally, impersonal orientations are more likely to be influenced by aspects that result in a lack of agency over their own actions such as the presence of depression (Malinowska & Tokarz, 2020). Current research offers evidence for positive relationships between general causality orientations and hypersomnolence in a student population (Taylor, 2020). Somnolence often occurs independently as a consequence of inadequate sleep duration (Parkes, 1981). It is also important to note, that somnolence can occur as part of a normal sleep cycle. However, when hypersomnolence occurs, an individual is unable to increase levels of arousal to a wakeful state (Peter-Derex, 2023). Therefore, the current study aims to explore further explore the association between somnolence, hypersomnolence and self-determination theory in higher education. Using questionnaire methods, the current study suggests negative relationships between autonomous orientations and hypersomnolence. As well as between control orientations and somnolence. The current study investigates the influence of self-determination theory in a higher education setting. The association between control orientation with somnolence and autonomy orientation with hypersomnolence ultimately suggests that the experience of somnolence and hypersomnolence are distinct in higher education. Thus, somnolence and hypersomnolence in a student population require alternative interventions when utilising general causality orientation.

Introduction

Sleep is a basic need of human survival, the physiological process supports restoration and cognitive functioning (Uday, 2026). Thus, one would suggest that the motivation to sleep is evident. Yet, it is increasingly reported that individuals are experiencing high levels of hypersomnolence and daytime dysfunction (Burrows et al., 2024). This paper attempts to understand how basic psychological needs fulfilment and self-determination theory orientations may undermine one's motivations to sleep and how orientations may facilitate the progression of sleep problems. Thus, highlighting an important factor to consider in the promotion of healthy sleep.

Self-determination theory (Deci et al, 2001) identifies three basic psychological needs essential for psychological, social, and physical health: autonomy, competence, and relatedness. Autonomy is a need for volition and self-endorsement in one's activities, competence refers to the need for effectiveness when interacting with one's environment, and relatedness involves the need for reciprocal care and concern for others (Ryan & Deci, 2001). Related to psychological needs are general causality orientations, which describe how individuals differ in degrees to which they are motivated by the three orientations: autonomous, controlled, and impersonal (Deci & Ryan, 2004). Those with an autonomous orientation regulate their motivation through their values, goals, and interests; controlled orientations are regulated through external pressures such as punishments or rewards; and impersonal orientations do not perceive personal agency in their ability to control what happens to them (Malinowska & Tokarz, 2020). The development of

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these orientations is driven by the satisfaction of the basic psychological needs, specifically, those with high autonomy orientation meet their needs for autonomy, competence, and relatedness; high control orientations meet competence and relatedness but not autonomy, whereas high impersonal orientations do not meet any basic psychological needs (Lombas et al., 2018; Autin et al., 2022). Recent research supports these connections, for example, a review of 23 studies from Europe and the USA identified that the basic psychological need satisfaction and higher autonomous motivation orientation was associated positively with well-being indicators, such as life satisfaction and positive affect, but negatively associated with depression and anxiety (Tang, Wang, & Guerrein, 2020). Similarly, Schuler et al. (2014) argue that satisfaction of autonomous needs results in higher autonomous motivations and autonomous motivation orientations results in higher well-being. Additionally, self-determination theory has been widely studied in student populations with the satisfaction of basic psychological needs correlating with positive educational outcomes (e.g., Wang & Tsai, 2020; Garn et al., 2019; Luchian & Boiangiu, 2020; Zhou et al., 2021; Buzzai et al., 2021), improved well-being, and a reduction in negative experiences within education (e.g., Hagenaur, Glaser-Zadiku & Moschner, 2018; Stubbs et al., 2024). As such, the most important basic psychological need appears to be autonomy, which has been highlighted above the other needs as it has been shown to be a key facilitator for well-being (e.g., Yu et al., 2020).

Similarly, there is a connection between fulfilment of self-determination theory, behaviour change and positive health outcomes (Ng et al., 2012). These findings have been heavily replicated in the area of physical health and activity (e.g., Li et al., 2024; Granero-Jiminez et al., 2022; Saeedian et al., 2025; Nunes et al., 2024). Thus, with sleep being a key physiological function one could find it a natural progression that this research would continue into sleep. Recent research has highlighted that there is a link between the fulfilment and frustration of basic psychological needs and sleep disturbance in workplaces (Niemiec et al., 2022). Research by Cambell et al. (2016) found that sleep quality mediated the association between self-determination theory and physical and mental health. Therefore, highlighting a not yet understood link between basic psychological needs and sleep. It has already been highlighted within the literature that sleep is important to student functioning due to cognitive deficits in domains such as working memory in students who experience poor sleep quality (Zavecz et al., 2018, 2020). However, there is also an important consideration of basic psychological needs for this population as these needs have been found to be negatively correlated with sleep hygiene (Reid & Dautovich, 2023), subjective sleep quality (Campbell et al., 2019; Uysal et al., 2019), sleep disruption (Howell et al., 2019; Niemiec et al., 2022), sleep duration (Campbell et al., 2021), and bedtime procrastination (Kadzikowska-Wrzosek, 2020). Previous evidence also suggests that higher perceived satisfaction of basic psychological needs during exam periods is associated with an increase in sleep quality and perceptions of daytime functioning (Campbell et al., 2015, 2018; Tavernier et al., 2019). Perceived autonomy, and thus autonomous motivation orientations, was one of the strongest predictors in the changing of sleep hygiene behaviours (Kor & Mullan, 2011) and positive health behaviours (Tam et al., 2019), while controlled orientations are related to negative health behaviours such as marijuana use, unhealthy eating, and risk-taking sexual behaviours (Tam et al., 2019). However, increased autonomy has also been found to increase undesirable bedtime behaviours such as bedtime procrastination (Kadziwoska-Wrzosek, 2020) and device usage (Tashjian, Mullins & Gulvan, 2019). This therefore suggests a multi-directional relationship with autonomy and sleep behaviours that requires further investigation. Thus, further examination is required to explore the relationship between general causality orientations and sleep. There is potentially a suggestion that autonomy may undermine or facilitate our motivation to sleep.

An area that has currently not been investigated considering basic psychological needs are the concept of somnolence and hypersomnolence. Somnolence can be defined as an inability to maintain alertness due to the manifestation of the drive to sleep (Kyle et al., 2014) and can become problematic when occurring outside of usual bedtimes (Black al., 2005). Yet, when this loss of alertness occurs excessively, consistently, and intrudes on diurnal functioning, it can be considered as hypersomnolence (Dauvilliers et al., 2017). Due to this, one would expect hypersomnolence to occur alongside or in trajectory with somnolence. This difference is widely acknowledged in the sleep literature with somnolence measured using the Stanford Sleepiness Scale (Hoddes et al., 1973), whereas hypersomnolence is measured using the Epworth Sleepiness Scale (Johns, 1991). Emerging literature has highlighted both somnolence and hypersomnolence within student populations (Burrows & Millett, 2024). Interestingly, although there is evidence examining sleep quality in a student population with basic psychological need (Zavecz et al., 2018, 2020); experiences of somnolence and hypersomnolence alongside basic psychological needs remain understudied in this population. Yet, there is evidence this may be a crucial consideration. For example, in one recent study, Taylor (2020) highlighted the association between not meeting one's basic psychological needs with higher controlled and impersonal orientations being associated with smartphone addiction, which in turn was associated with hypersomnolence. Ultimately this

study is of importance for two reasons. First, this study is of conceptual interest highlighting how basic needs satisfaction may undermine the basic need of sleep resulting in higher levels of somnolence and consequently hypersomnolence. Furthermore, this study offers a unique perspective by only examining the relationship between self-determination theory and hypersomnolence, which to the best of our knowledge, has only been researched in relation to smart phone addiction (Taylor , 2020). Thus, to further examine how self-determination theory is associated with hypersomnolence and somnolence, this paper will explore the relationship between autonomous, controlled, and impersonal motivation alongside somnolence and hypersomnolence in a student sample. Based on previous literature, on sleep quality and quantity (Kor & Mullan, 2011; Tam et al., 2019), we hypothesise that autonomous orientations will be related to the experience of hypersomnolence, while higher control and impersonal orientations potentially exacerbate hypersomnolence and somnolence.

Methodology

Participants

G*Power (version 3.1.9.2, Faul et al., 2009) was used to calculate the required sample size. Number of predictors was set to 3, whereas effect size (0.3), α error probability (0.05), and statistical power (1-β err prob = 0.95), were preset and left untouched. The G*Power calculation demonstrated non-centrally parameter λ of 17.8500000, critical F of 2.6834991, Numerator df of 3 and Denominator df of 115. Therefore, the overall sample size required was 119. Online data collection permitted for extra participants to be collected to allow for dropout rates, however an unexpected number of responses were received during the data collection phase. Opportunity sampling was used throughout this study. A total of 278 participants were recruited during online data collection. All participants were students enrolled in higher education institutions in the United Kingdom. Due to this a post hoc power analysis was completed. A post hoc power analysis was conducted using G*Power (Faul et al., 2007) to assess the achieved power for a multiple linear regression with 3 predictors. The analysis was based on an effect size of 0.2, an alpha level of α = 0.05] and a total sample size of 278. The results indicated that the achieved power (1-β) was 0.99 suggesting that the study had sufficient power to detect the hypothesized effect. Demographic information is displayed in Table 1.

Table 1 Demographics information

	Frequency (%)	Age (SD)	Age range
Overall	278 (100%)	26.27 (7.94)	18–59
Female	239 (*86%*)	26.03 (*7.76*)	18–58
Male	30 (*10.8%*)	28.43 (*9.89*)	20–59
Non-Binary	9 (*3.2%*)	25.66 (*4.27*)	20–34

Design

A correlational design was employed. A path analysis was conducted highlighting the relationship between Hypersomnolence, Somnolence, Autonomy, Control and relatedness.

Materials

Three Psychological Scales were used: the Epworth Sleepiness Scale to measure hypersomnolence (ESS; Johns, 1991) which has been validated with student and non-student populations (Manzar et al., 2019).This scale has a cronbach's alpha of 0.88 (Johns, 1992) which indicates a good level of validity. Within this study the scale had a cronbach's alpha of 0.76. This scale consists of 8 items and participants are asked to rate how likely they are to fall asleep in 8 situations such as 'sitting and reading', 'watching television' and 'sitting down after lunch with no alcohol'. Scores on this scale range from 0 to 24, with higher scores suggesting higher levels of hypersomnolence.

The Stanford Sleepiness Scale to measure somnolence (SSS; Hoddes et al., 1973). This scale consists of a single item, with participants being asked how sleepy they are in the current moment. Somnolence ranges between 1 and 7 with 1 equivalent to feeling alert and 7 feeling the onset of sleep is soon. Higher scores relate to higher levels of somnolence.

Finally the General Causality Orientation Scale - which consists of three subscales, control, impersonal, and autonomy, which measured general causality orientations (Deci & Ryan, 1985). Within this scale, participants are given a series of 17 situational vignette's and they are asked to rate 1–7 how likely they would be to take the described action. For example: '*You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think: It's not what you know, but who you know. 1 2 3 4 5 6 7*'. Each variable (autonomy, impersonal and control) has an individual score, and scores have a maximum of 84, with higher scores indicating a higher level of each orientation. This scale has a good internal validity with Cronbach's alphas available for each subscale: Autonomy, (α = 0.86) Control, (α = 0.71) Impersonal, (α = 0.76; Sen & Dag, 2016). Similar scores have been calculated for the current study: Autonomy (α = 0.53); Control (α = 0.62); Impersonal (α = 0.45). Details of the scales are summarised in Table 2.

Table 2 Overview of scales

Factor	Instrument and sample item	Number of items	Original Cronbach's α	Current study Cronbach's α
Hypersomnolence	Epworth Sleepiness Scale, ESS, (Johns, 1991), '*sitting and reading'* and '*watching television*'	8	0.88 (Johns, 1992)	0.76
Somnolence	Standford Sleepiness Scale, SSS, (Hoddes et al., 1973), '*feeling active*, *vital*, *alert or wide awake*'	1	-	-
Autonomy, Control, and Impersonal Motivation	General Causality Orientation Scale, GCOS, (Deci & Ryan, 1985). 1–7 whether responses are 'likely' or 'not likely' to reflect the participant's own response to the situation. Example: '*You had a job interview several weeks ago. In the mail you received a form letter which states that the position has been filled. It is likely that you might think: It's not what you know, but who you know. 1 2 3 4 5 6 7*'	17	Autonomy, (α = 0.86) Control, (α = 0.71) Impersonal, (α = 0.76) (Sen & Dag, 2016)	Autonomy (α = 0.53); Control (α = 0.62); Impersonal (α = 0.45).

No Cronbach's alpha is provided for the Stanford Sleepiness Scale, as this scale is a single item scale

Procedure

Ethical approval was granted by the University of Suffolk Ethics Committee on 1 st June 2021 (RETH20/070. The study was delivered online via QuestionPro. Participants received an information sheet and consent form before the survey, outlining the project's purpose and potential risks. Participants were then provided with the Epworth Sleepiness Scale, Stanford Sleepiness Scale, and the General Causality Orientation Scale in a counterbalanced order before finally providing their demographic information, including sex, gender, age, and current educational status.

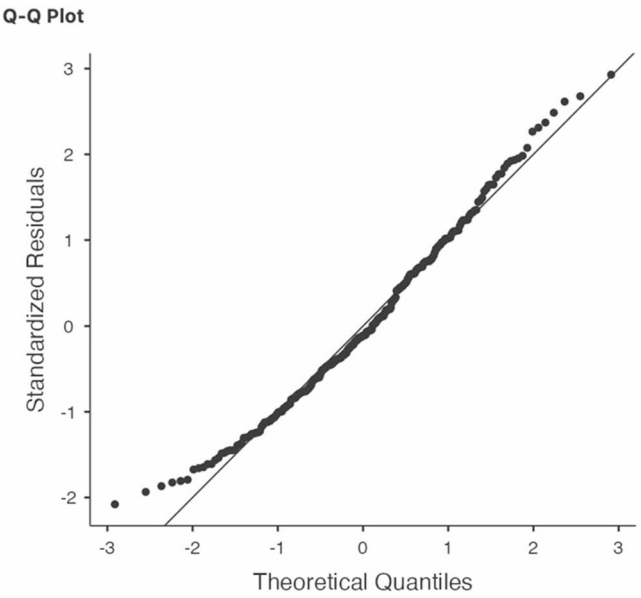

Fig. 1 Demonstrating the distribution of the data collected

Data analysis

To explore the relationship between general causality orientation and sleepiness, a path analysis was performed with autonomy, control, and impersonal orientations as predictor variables and hypersomnolence and somnolence as outcome variables. Before analysis took place, multicollinearity between predictor variables was assessed and was not violated (Autonomy, tolerance = 0.72, VIF = 1.39; Control, tolerance = 0.81, VIF = 1.23; Impersonal, tolerance = 1.46, VIF = 1.46). Alongside this normality testing was also performed. A Q-Q plot is provided in Fig. 1. Demonstrating the normal distribution of the data. SPSS will be used to analyse and clean the data and JAMOVI will be used to perform statistical analysis.

Results

Means, standard deviations, and ranges for hypersomnolence, somnolence, autonomy, control, and impersonal orientation styles can be found in Table 3. Control orientation was the highest causality orientation for our student sample, followed by impersonal orientation, and finally autonomy orientation.

Somnolence, hypersomnolence and general causality orientations

The correlation matrix indicates that somnolence is correlated with autonomy, control, and impersonal orientations as well as hypersomnolence. Whereas hypersomnolence is only related to autonomy orientation and somnolence (see Table 4).

A path analysis was conducted to examine the direct and indirect effects of somnolence and hypersomnolence with motivation orientations (control, autonomy, and impersonal) as potential mediators. The analysis used standardised coefficients (β), and confidence intervals were computed using the Delta 2023method (Fig. 2).

A multiple mediation analysis was conducted to examine whether autonomy, control and impersonal orientations mediated the relationship between somnolence and hypersomnolence.

Results indicated a significant direct effect of somnolence on hypersomnolence, $\beta = 0.260$, $SE = 0.170$, $z = 4.431$, $p < .001$, suggesting that higher levels of somnolence were associated with changes in hypersomnolence. The total effect of somnolence on hypersomnolence was also significant, $\beta = 0.281$, $SE = 0.167$, $z = 4.871$, $p < .001$. Thus, highlighting the strong significant relationship between somnolence and hypersomnolence.

Bootstrapped confidence intervals (2000 samples) indicated that none of the indirect effects were significant. The indirect effects through autonomy showed no significant mediation effect, $\beta = 0.025$, $SE = 0.049$, CI [0.003, 0.192], $p = .132$, suggesting no direct pathway to which somnolence influences hypersomnolence via autonomy. In addition, the indirect effect through control $\beta = 0.003$, $SE = 0.048$, 95% CI [0.100, 0.094], $p = .859$, and the indirect effect through impersonal orientation $\beta = 0.002$, $SE = 0.026$, CI [0.057, 0.051], $p = .833$, was not significant.

Table 3 Means, standard deviation, and range for hypersomnolence, somnolence, autonomy, control, and impersonal orientation styles

Variable	Mean (SD)	Range
Hypersomnolence	7.20 (*4.31*)	0–22
Somnolence	3.4 (*1.49*)	1–7
Autonomy	49.33 (*8.04*)	26–77
Control	60.74 (*8.27*)	31–78
Impersonal	52.83 (*7.41*)	32–81

Hypersomnolence ranges from 0–24, with higher scores suggesting higher levels of hypersomnolence. Somnolence ranges between 1–7 with 1 equivalent to feeling alert and 7 feeling the onset of sleep is soon. For autonomy, control and impersonal, scores have a maximum of 84, with higher scores indicating a higher level of each orientation.

Table 4 Correlation, between, control, autonomy and impersonal motivation orientation styles, somnolence, and hypersomnolence

	Control	Autonomy	Impersonal	Somnolence
Control	—			
Autonomy	0.354***	—		
Impersonal	0.402***	0.507***	—	
Somnolence	0.231***	0.164**	0.118*	—
Hypersomnolence	0.096	0.185**	0.088	0.281***

* $p < .05$, ** $p < .01$, *** $p < .001$

Although the indirect effects were not significant, somnolence significantly predicted autonomy, ($\beta = 0.164$, $SE = 0.334$, $z = 2.656$, $p = .008$) and control ($\beta = 0.231$, $SE = 0.340$, $z = 3.778$, $p = .001$), and autonomy also significantly predicted hypersomnolence, ($\beta = 0.155$, $SE = 0.039$, $z = 2.128$, $p = .033$). Whereas control and impersonal orientations did not significantly predict hypersomnolence.

Overall, these results indicate that autonomy, control, and impersonal orientations did not significantly mediate the relationship between somnolence and hypersomnolence. However, Autonomy and control do significantly predict hypersomnolence.

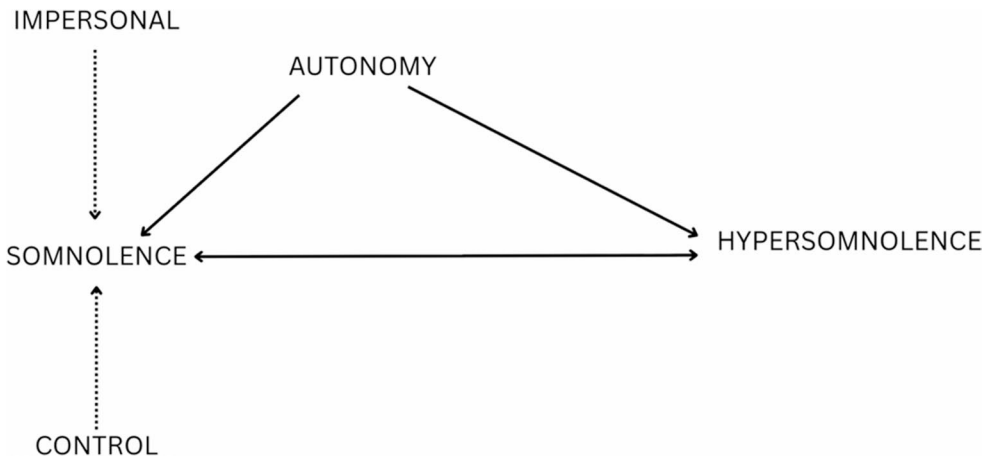

Fig. 2 Figure demonstrating the relationship between somnolence, hypersomnolence, with general causality orientations. Note. Bold lines indicate a significant pathway, while a dashed line indicates a significant correlation. No line connecting factors indicates no relationship

Discussion

The present findings highlight the complexity of the relationship between causality orientation styles and sleepiness. These results suggest that somnolence directly influences hypersomnolence as suspected, with autonomy being directly linked to both variables. However, control and impersonal motivation were correlated with somnolence but not hypersomnolence. Further, autonomy predicted hypersomnolence and somnolence. These findings highlight the importance of considering autonomy-related motivation as a potential variable that may indicate whether somnolence and hypersomnolence are experienced or reported. This suggests a nuanced relationship between motivational orientations and how they may influence hypersomnolence and associated behaviours. Thus, demonstrating the importance of considering general causality orientations and in particular autonomy when implementing sleep interventions.

Interestingly, we found a positive correlation between hypersomnolence and autonomy. Firstly, this finding alone is unsurprising, with autonomy already being highlighted as the strongest predicting factor of sleep behaviours by Yu et al. (2019). Furthermore, our findings contribute to the already complex relationships that have been highlighted by literature in this field, where autonomy orientation is usually associated with positive outcomes such as sleep quality (e.g., Song et al., 2022) or sleep hygiene (Mohideen et al., 2023). For example, Niemiec et al. (2022) demonstrated that participants who reported sleep issues, such as sleep fragmentation, were more likely to have experienced poor levels of autonomy, competence, and relatedness within the workplace. Recent research such as Coban-Tosyali-Bozo (2024) support these findings, by suggesting that autonomy and the other basic psychological needs, when satisfied, resulted in higher sleep quality. As such, it is interesting that those high in autonomy reported higher hypersomnolence in this study. Firstly, it is important to consider the relationship between sleep and hypersomnolence when framing these results. Hypersomnolence is ultimately defined as the perception of excessive sleepiness and as such, this can be underestimated in reporting (Peter-Derex et al., 2020). Thus, one could argue that those with higher autonomy are more likely to report feelings and perceptions of hypersomnolence when asked to. The implication of this means that individuals lower in autonomy, may be under reporting feelings of hypersomnolence. Sorscher (2014) highlights the burden that feelings of hypersomnolence place on primary care through fatal accidents and workplace accidents, as such, one could wonder if reporting of hypersomnolence in primary care could be improved by ensuring that those with lower autonomy are screened regularly for hypersomnolence when visiting primary care for potentially comorbid conditions. Secondly, high levels of hypersomnolence could be attributed to feelings of autonomy and other psychological needs not being met. Uysal et al. (2020) offer an interesting explanation that could help explain the current findings. Uysal et al. (2020) suggest that when basic psychological needs are not satisfied, frustration towards this can be detrimental towards health outcomes. Thus, feelings of autonomy not being met could result in poorer sleep outcomes. Thus, this could further explain our previous suggestion that basic psychological needs are able to undermine our need to sleep. Further research should investigate autonomy and sleep behaviours as well as sleep outcomes to determine why feelings of hypersomnolence may be occurring. For example, higher levels of autonomy may result in higher levels of negative sleep behaviours in some populations such as bedtime procrastination and cell phone use (Tashjian, Mullins and Galvan, 2019).

Although not consistent with all findings, the current findings, do align with previous research on other undergraduate populations where autonomy is related to poor sleep due to the transitional phase of education (Nothard et al., 2015; Doane et al., 2015; Campbell et al., 2018). To reiterate, Foulkes et al. (2019) demonstrated that poor sleep within cohorts of first-year university students was related to shifting university schedules and proximity to peers for the first time, as autonomous motivations could potentially exacerbate the need to socialise. As a need for autonomy outside of the educational schedule could be causing students to forsake sleep to fulfil these activities. In other words, autonomous motivations are undermining one's motivation to sleep by prioritising other behaviours. This research therefore suggests that autonomy may be related to poor sleep and feelings of hypersomnolence in a student population. Thus, suggesting that students experiencing high levels of hypersomnolence could be explained by behaviours such as deprivation, or sleep extension that are related to autonomy. Although it is not possible to observe this from the current data, future research should record a range of sleep behaviours to investigate how autonomy may mediate this relationship. Maskevich et al. (2022) postulated this within the student population, by demonstrating that students transitioning to higher education may experience self-regulation of their sleep for the first time. This is suggested to contribute to the experience of hypersomnolence by Burrows and Millett (2024). To further clarify this, the current study fits with previous suggestions that high levels of autonomy, within higher education, may encourage behaviours that result in reduced sleep such as bedtime procrastination (Hill et al., 2022) and cell phone use before bed (Tashjiaan et al., 2019). Beyond the lifestyle changes associated with moving to university, there is evidence that this association between sleep and autonomy can be found in younger people more

generally. Specifically, Tashjian, Mullins and Galvan (2019) suggest that bedtime autonomy may decrease sleep duration in adolescence, as significant time is spent on cell phones prior to sleeping. Furthermore, it has been demonstrated by Kadzikowska-wrzosek et al. (2020) that mediation between bedtime procrastination and controlled motivational regulations, impact sleep parameters, such as bedtime procrastination and sleep deprivation. Our findings suggest that these adolescent associations may continue into early adulthood. Speculatively, these findings, paired with the previous literature, may suggest that students and young people may procrastinate, when going to bed, to spend time doing other hobbies, such as watching television, using mobile phones, or spending time with friends. Alternatively, students could be extending their sleep to cope with feelings of somnolence, that may result in sleep inertia. Either suggestion could help explain high levels of hypersomnolence within a student population. Consequently, future research would benefit from focusing on why increased autonomy could result in restricted or extended sleep within students.

One would also note that similar findings have been found within other sleep domains such sleep hygiene (Reid & Dautovich, 2023), subjective sleep quality (Campbell et al., 2019; Uysal et al., 2019), sleep disruption (Howell et al., 2019; Niemiec et al., 2022), sleep duration (Campbell et al., 2021), and bedtime procrastination (Kadzikowska-Wrzosek, 2020). However, this study is unique in highlighting the relationship between hypersomnolence, somnolence and autonomy. Thus, highlighting perceived autonomy is related to feelings of sleepiness.

The current findings also have practical implications within the growing field of sleep education. It could be suggested that sleep education may influence students with increased autonomy to make positive sleep choices. For example, Cortesti et al. (2004) highlighted that an educational programme significantly increased student's knowledge of sleep and increased long term sleep outcomes. Including, a reduction in somnolence. However, many educational programmes such as the implemented by Chung et al. (2017) highlight only short-term benefits on the sleep of students, with students not continuing to extend sleep during followed up assessments. Similar findings were found by Vollmer et al. (2014), who demonstrated that when sleep education programmes utilized self-determination theories within their programmes; sleep education made sleep practices worse in the long term, with students practising higher bedtime autonomy. However, our current findings may suggest that this is because educational programmes should take into consideration both autonomy and control when developing their programmes. Further research should therefore focus on the implementation of self-determination based educational sleep programmes within higher education samples, using both autonomy and control. Alternatively, its other interventions based on the encouragement of good sleep health and increasing sleep knowledge have been demonstrated as efficient in secondary school age children (McCrory et al., 2021, 2023). Thus, whether these interventions prove successful in a higher education setting or integrated within a self-determination theory-based intervention could be a worthwhile future pursuit.

Outside of a student population, self-determination theory has already been used to develop interventions within the field of sleep. Felipe and Cura (2020) investigated the difference between self-determination theory-based interventions on obstructive sleep apnoea (OSA) patients. Patients within the experimental group, using self-determination theory-based interventions saw better adherence to continuous positive airway pressure therapies than their non-experimental counterparts. With patients experiencing OSA it could be that they are also experiencing high levels of hypersomnolence, therefore increasing levels of autonomy may also reduce levels of hypersomnolence as highlighted by the association found in the current study. Although it may also be important for OSA patients to consider the current findings, this suggest that we should not solely focus on increasing autonomy, but also in decreasing control, to support those experiencing hypersomnolence and somnolence.

Our research therefore suggests that other interventions should consider general causality orientations when developing interventions. For example, research by Patel and Cheung (2024) suggests that exercise training can be beneficial to those experiencing hypersomnolence by alleviating poor sleep quality and indirectly improving hypersomnolence. This research suggests that exercise could be used as an important intervention within students to resolve feelings of hypersomnolence, thus, an understanding of student's causality orientations could assist in exercise adherence, making exercise interventions a viable option for mild to moderate hypersomnolence (Silva et al., 2008; Teixeria et al., 2012. Consequently, this research has important applications for patients experiencing hypersomnolence, as understanding one's motivation orientations may make the detrimental effects of hypersomnolence easier to manage.

Several limitations were present within this study. Firstly, the current study would benefit from longitudinal measures, with both sleep and general causality orientation being tracked across a student's time at university. The results found in a student population may be attributable to the instability of orientations within education with autonomy decreasing after the first year (Corpus et al., 2020). The results could also be affected by changes over time in sleep (e.g., Rayward et al., 2018). Sleep behaviours, such as sleep duration, can vary or adapt over periods of time as short as two years (Rayward et al., 2018). Consequently,

as both variables fluctuate over the course of higher education, further research is required to assess this relationship. Finally, it can be argued that the reliability of the general causality orientation measures used within this study were low (see *Materials*). However, within the self-determination theory literature, the general causality orientation scale consistently demonstrates moderate to poor internal consistency with several studies reporting alphas in the moderate to low range (e.g., Rose et al., 2001–0.59–0.77.59.77; Drugas, Giannouli, Stoyanova & Ivanova 2020, −0.66 to 0.76; Wong, 2000–0.59–076.59; Lam & Gurland, 2008–0.59–0.77.59.77; Williams et al., 1996–0.58–0.77.58.77). This is likely attributed to the scale's format (heterogeneous vignettes) thus, highlighting the need for further development of applicable scales in this field. Furthermore, it is of note that all constructs measured by the General Causality Orientation scales are likely to be related. Subsequently, it is not unexpected that the Cronbach alphas for this scale would be low when used within research together. Nonetheless, significant findings in one domain on the scale and not all three domains highlight the value of these subdomains in motivation research. However, further work would benefit from incorporating alternative methods for measuring motivation, alongside these scales, for example Rotter's (1966) Locus of Control scale.

Ultimately, our results suggest that those with autonomous motivation orientations are more likely to report feelings of hypersomnolence. Although from this study it is unclear whether this is due to autonomy increasing negative sleep behaviours or autonomy resulting in participants being more likely to report perceptions of hypersomnolence. Thus emphasising the importance of examining hypersomnolence and somnolence separately in students alongside general causality orientations. With hypersomnolence being related to autonomy and somnolence being related more closely to control orientations. This finding suggests differences in motivation and the severity of sleep issues in students. Further work should examine the reasoning as to why students feel or behave the way they do regarding sleep and sleep issues.

In conclusion, this study is the first of its kind to highlight the relationship between both somnolence and hypersomnolence and general causality orientations within students. Our findings suggest that elevated autonomous orientations are a significant predictor of hypersomnolence whereas higher control orientations were a significant predictor of somnolence. Thus, this study suggests that sleep education interventions in higher education need to focus on maintaining a balance between general causality orientations and to consider different factors for those with hypersomnolence and somnolence.

Authors' Contributions AM managed the project, KB conceived the theoretical work, undertook all the experimental work, AM and KB drafted the manuscript, AM, KB, KM reviewed and edited the manuscript.

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Data Availability Upon publication the data and materials for this study will be made available from request of the corresponding author.

Code Availability Not applicable.

Declarations

Ethical Approval The study was conducted in accordance with the British Psychological Society code of Ethics and approved by the University of Suffolk Ethics Committee (Approval Reference RETH20/070).

Human Ethics and Consent to Participate. Informed consent was obtained from all participants involved in the study.

Clinical Trial The current study did not use clinical trials.

Competing interests The authors declare no competing interests.

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